

Developmental Coordination Disorder in grade 1 learners

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Abstract

Since the 1900's the scientific community has acknowledged a large group of children who develop well intellectually but experienced movement skill difficulties. Developmental Coordination Disorder (DCD) is defined as children who experience motor coordination difficulties which impedes functional performance and interfere with their academic achievement, physical- and psychological development as well as activities of daily living. Therefore, the purpose of the study was; to determine the prevalence of DCD amongst Grade 1 learners, to establish the boy-girl ratio regarding DCD and the prevalence of DCD amongst various ethnic groups. Five-hundred and fifty nine learners between the ages of 6 and 8 years took part in this study. There were n=321 girls (57%) and n=238 boys (43%) of various ethnical groups, which consisted of 57.4% Caucasian, 39.7% Black, 2.50% Mixed-race, 0.3% Hispanic and 0.1% Indian children. The Movement Assessment Battery for Children-2 (Movement ABC-2) was used to determine DCD. The results indicated that 85% participants had no motor difficulties (green zone), 8% of children in the group were identified with moderate motor difficulties (amber zone), while 7% were identified with severe motor difficulties (red zone). With regard to the boy-girl ratio, the boys had 9% moderate difficulties and 10% severe difficulties in contrast to 7% moderate difficulties and 5% severe difficulties amongst the girls. With reference to ethnic groups, 5.3% of Caucasian learners fell in the amber zone and 5.3% in the red zone, 10.6% of Black learners fell in the amber zone and 9.7% in the red zone, 14.2% Mixed-race learners fell in the amber zone and 21.4% in the red zone. The conclusions drawn from the results suggest that the prevalence of DCD amongst Grade 1 learners in Bloemfontein is estimated to be 15%. The results also indicate that boys have a significantly higher ($p=0.0507$) prevalence of DCD when compared to their female counterparts.

Keywords: Developmental coordination disorder, movement assessment battery, for children-2, grade 1 learners

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Introduction

Developmental coordination disorder (DCD) can be seen as a disorder that influences children's daily living activities, although no obvious cause is evident. Developmental coordination disorder can be defined as a: "marked impairment

in the development of motor coordination that is not explicable in terms of general intellectual retardation or of any specific congenital or acquired neurological disorder” (Henderson *et al.*, 2007). According to Missiuna *et al.* (2007), DCD also include children that experience significant difficulties in motor learning and in the performance of functional motor tasks that are critical for success in their daily lives such as activities at home, school and during play.

Developmental coordination disorder affects children all over the world. Researchers in the United Kingdom estimated the prevalence between 4-5% (Lingam *et al.*, 2009). According to Hamilton (2002) 6% of children in the United States of America are diagnosed with DCD. Junaid *et al.* (2000) found that approximately 8-15% of Canadian children have some form of coordination problems. America and Europe have a higher prevalence than the United Kingdom and New Zealand. Between 5-19% of children have been found to have motor problems (Miler *et al.*, 2001). The real prevalence of DCD among children might even be higher, since medical as well as educational systems frequently fail to identify this disorder in young children (Gains & Mussiuna, 2006; Missiuna *et al.*, 2007; Miyahara *et al.*, 2008).

Gender also plays a role with regard to DCD. Literature indicates that boys experience more problems than girls, with a boy-girl ratio of 3:1 (Hoare & Larkin, 1991) and 2:1 (Wright & Sugden, 1996). Reported in previous studies, according to Wessels *et al.* (2008) the ratio is 2-3:1. Although children diagnosed with DCD have certain difficulties, with motor dysfunction being the core of all the problems, the children are a heterogenic group (Gillberg, 1998; Geuze *et al.*, 2001; Dewey & Wilson, 2001). This implies that no two children are the same and that negative effects experienced could vary between children.

Major concerns relating to DCD are the considerable harmful effects associated with this disorder. Developmental coordination disorder influences children’s daily activities at home (dressing and using various tools), normal play (running, riding a bike, swimming and ball games) and in school (writing and cutting activities) (Schoemaker *et al.*, 2003; Sudgen & Wright, 1998). Secondary problems associated with DCD are physical health, such as obesity and lower aerobic levels due to lower activity levels (Cantell *et al.*, 2003; Tsiotra *et al.*, 2009), social, emotional and academic problems (Piek & Edwards, 1997; Cantell *et al.*, 2003). Other related problems linked to DCD are attention deficit hyperactivity disorder (ADHD) (Pitcher *et al.*, 2003; Watemala *et al.*, 2007; Wessels *et al.*, 2008); speech and language disorders (Gaines & Missiuna, 2006), as well as visual-motor deficits (Wilmot *et al.*, 2007).

Methodology

Study design

This empirical study made use of quantitative and qualitative approach to collect data. The study involved one testing procedure in order to determine the prevalence of DCD amongst Grade 1 learners in Bloemfontein. In addition, the boy-girl ratio regarding DCD as well as the prevalence of DCD amongst various ethnic groups were determined. The cut-off scores used in this study was based on Henderson *et al's.* (2007) recommendations, which are as follows: severe motor difficulties ($\leq 5^{\text{th}}$ percentile), moderate motor difficulties (5^{th} - 15^{th} percentile) or children having no motor difficulties ($>15^{\text{th}}$ percentile). The participants were tested at their schools by eight Kinderkineticists who are familiar with the testing procedures of the relevant instrument. Each Kinderkineticist was responsible for one of the eight subtests to ensure consistency across the study.

Participants

Initially 13 schools in the Bloemfontein area were targeted to take part in the research project but only seven schools eventually agreed to participate. The Department of Education as well as the principals of each school gave permission for the research to be conducted on the school premises during the life orientation periods. Approval had been obtained from the Ethics Committee of the Faculty of Health Sciences, University of the Free State (ECUFS57/2012). The parents of the participants completed an informed consent form for each child participating in this study. All children in the identified classes were considered for inclusion into the study. Exclusion criteria included a child in the age group outside the expected range from 5-8 years, parental permission not obtained or the informed consent form not completed fully or parents indicating that they would be relocating during the study. Five-hundred and fifty nine ($n=559$) learners in Grade 1 (the youngest being 5 years and 8 months old and the oldest 8 years and 4 months old) took part in the study. The study consisted of boys ($n=238$) and girls ($n=321$) who belonged to various ethnic groups (Caucasian: $n=320$; Black: $n=222$; Mixed race: $n=14$; Hispanic: $n=2$; and Indian: $n=1$).

Measuring instruments

The Movement Assessment Battery for Children-2 (Movement ABC-2) is a standardised test (Henderson *et al.*, 2007) and the reliability coefficient for the total test scores was 0.80 (Henderson *et al.*, 2007; Mayson, 2007). Unfortunately research on validity is only available with regards to the original MABC

(Mayson, 2007). Henderson *et al.*, (2007) state that the original MABC performance test is a valid test to use. The authors observed the correlations between the test components which ranged between 0.25 and 0.36, indicating a relatively low correlation. Although, a moderate to good correlation was established by Mayson (2007) between the test components and the total test score 0.65 and 0.73.

The Movement ABC-2 requires children to perform a series of motor tasks in a specified manner. In addition to age-related norms, the test also provides qualitative information on how children should approach and perform the tasks. The Movement ABC-2 assesses the subject's motor proficiency levels and diagnoses children with DCD. The first assessment component of this test battery contains 24 items organized into three sets of eight tasks. Each set is designed for use with children of a different age band. The eight tasks are grouped under three headings, namely manual dexterity (MD), balance (B) as well as aiming and catching (AC) (Henderson *et al.*, 2007). Age-adjusted standard scores and percentiles are provided, as well as a total test score for each of the three components of the test. The total test score can be interpreted in terms of a 'traffic light' system. The green zone indicates performance in a normal range ($>15^{\text{th}}$ percentile), while the amber zone indicates that a child is at risk and needs to be carefully monitored (5^{th} - 15^{th} percentile). The red zone is an indication of definite motor impairment ($\leq 5^{\text{th}}$ percentile).

Statistical analysis

The researchers captured data electronically in Microsoft Office Excel 2007. Analysis of the data was done by a biostatistician using Statistical Analysis Software Version 9.1.3. Descriptive statistics, namely frequencies and percentages, were calculated for categorical data. Medians and percentiles were calculated for numerical data. Median differences were tested by calculating p-values using the signed-rank test. The Chi-square statistics were used to test for proportion differences. Probability level of 0.05 or less was taken to indicate statistical significance.

Results

Table 1 represents the numerical data of the mean procedure for the various subtests of the Movement ABC-2 results.

Table 1: The mean procedure of the Movement ABC-2 results

Variable	n	Lower Quartile	Median	Upper Quartile
MD	551	5.0	16.0	37.0
AC	551	37.0	63.0	84.0
B	551	37.0	50.0	75.0
TTS	551	16.0	37.0	63.0

Abbreviations: n = sample size, MD = Manual Dexterity, AC = Aiming and Catching, B = Balance, TTS = Total Test Score

Table 1 shows the results of the 551 children specific to each subtest using the median procedure. The lower quartile represents the 25th percentile, which means that 75% of the children will obtain better results. The upper quartile is the 75th percentile, thus implying that only 25% would obtain better results. The data in Table 1 indicates that the median score for manual dexterity was 16 with an interquartile range of 5 to 37. With reference to aiming and catching, the median score was 63 and the interquartile range was 37 to 84. Balance has a median score of 50 and ranged between 37 and 75. The total test score was derived from the three subtests. The median was 37 and the interquartile range was 16 to 63. It is clear that children had the greatest difficulty performing the manual dexterity subtest.

The distribution of the children according to the traffic light system (degree of motor difficulty) according to the MABC-2 test is illustrated in Figure 1.

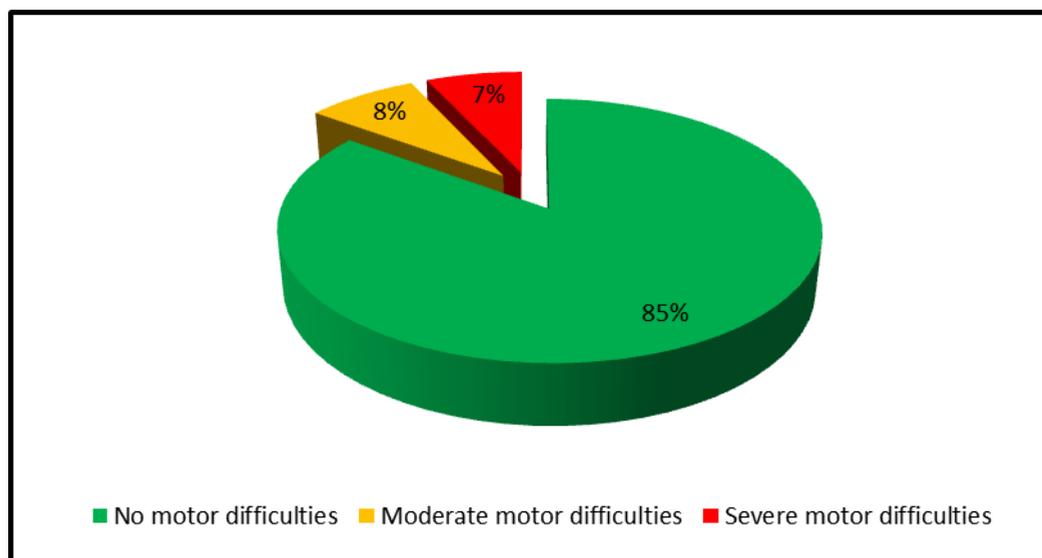


Figure 1: Prevalence of DCD in Grade 1 learners

Figure 1 presents the percentages with regard to the traffic light system. Green indicates no motor difficulties (85%), amber indicates moderate motor

difficulties (8%) and the red zone indicates severe motor difficulties or DCD (7%) amongst Grade 1 learners in Bloemfontein. It is interesting to note that more children are experiencing motor difficulties than previously indicated. The distribution of the girls and boys according to the traffic light system (degree of motor difficulty) according to the MABC-2 test is shown in Figures 2 and 3.

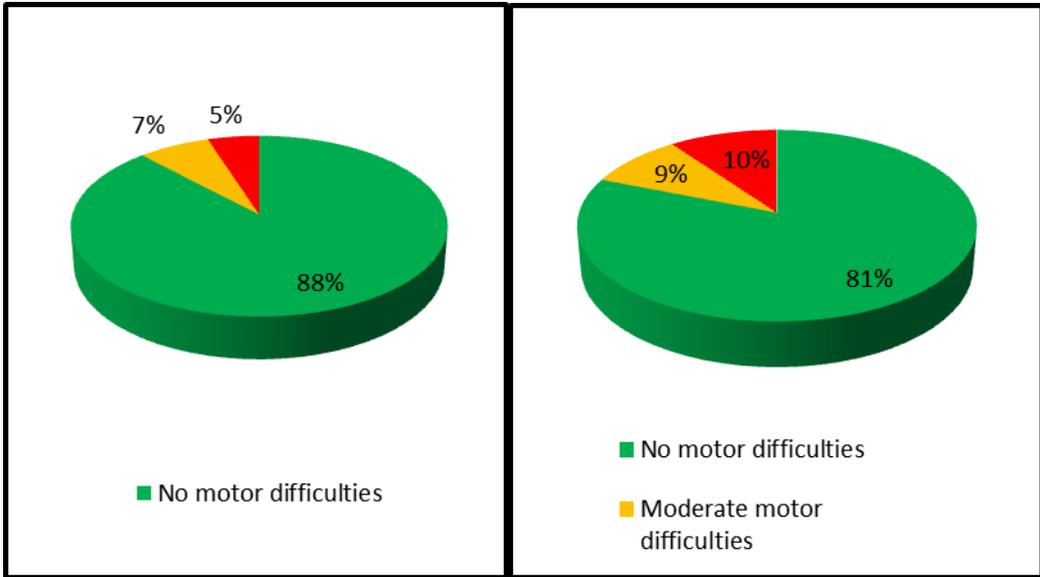


Figure 2: Traffic light categories for girls. **Figure 3:** Traffic light categories for boys.

As expected Figures 2 and 3 indicated that boys had a significant ($p=0.0507$) higher prevalence of DCD than girls, although marginally. Eighty eight per cent (88%) of the girls fell in the green zone compared to 81% of boys. With reference to the amber zone, 7% of girls had moderate motor difficulties in contrast to 9% of boys. The red zone indicates that 5% of girls had severe motor difficulties compared to 10% of boys.

The distribution of the various ethnic groups according to the traffic light system (degree of motor difficulty) based on the MABC-2 Test is shown in Figure 4.

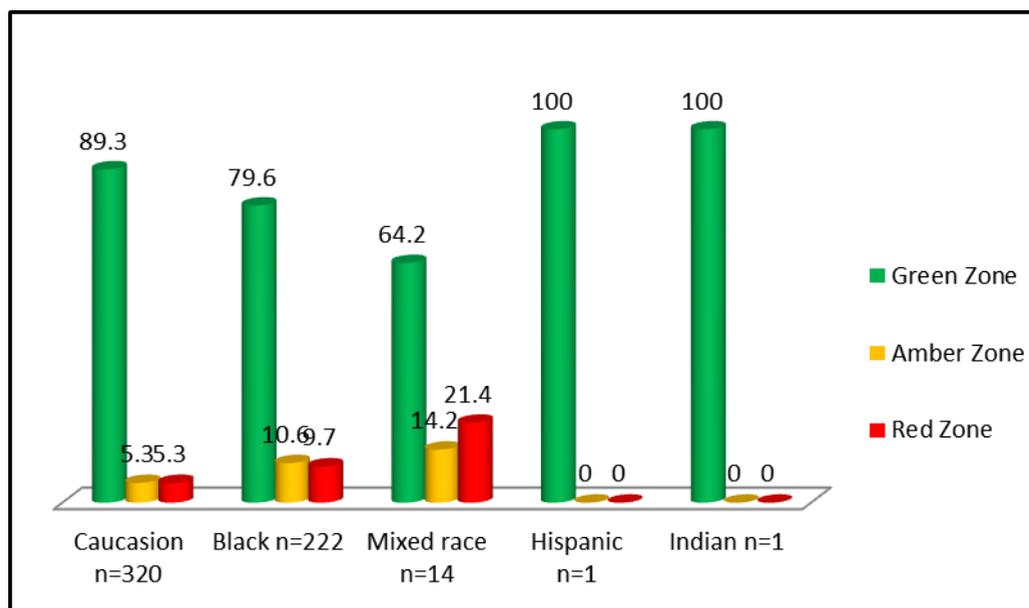


Figure 4: Prevalence of DCD in Grade 1 learners according to ethnic groups

While 89.3% of Caucasian children experienced no motor difficulties, 79.6% of Black children, 64.2% Mixed-race children and both the Hispanic and Indian child fell in the green zone (Figure 4). With regards to the amber zone, 5.3% of Caucasian children experienced motor difficulties, 10.6% of Black children and the percentage were even higher for the Mixed-race children 14.2%. Observing the red zone, 5.3% of Caucasian children experienced severe motor difficulties, 9.7% of Black children and again the percentage was higher for the Mixed-race children at 21.4%. There was a statistically significant difference ($p=0.0192$) in DCD between the various ethnic groups.

Discussion

DCD affects children all over the world, but the prevalence differs substantially in various countries. In the current study, it was found that at least 15% of the sample had moderate to severe motor difficulties. These statistics are in contrast to various findings reported in the literature where the researchers state that DCD affects more or less 5-6% of school-age children (APA, 2000; Gaines & Missiuna, 2006; Prado *et al.*, 2009). Researchers in the United Kingdom estimated the prevalence between 4-5% (Lingam *et al.*, 2009), which is much lower than the 15% found in the present study. Wilmut *et al.* (2007) found a higher prevalence of DCD (5-10%), but this is still 5% lower than that obtained in the current study.

The research findings of Junaid *et al.* (2000) correlate best with that of the current study. These researchers found approximately 8-15% of Canadian

children to have some form of coordination problems. Studies in America and Europe found an even higher prevalence of DCD, estimated at 5-19% (Miller *et al.*, 2001). According to Gains & Mussiuna, (2006), Missiuna *et al.* (2007) and Miyahara *et al.* (2008) medical- and education systems often fail to identify DCD in young children and therefore the prevalence might be higher.

The current study found that boys exhibit significant ($p=0.0507$) more moderate to severe motor difficulties compared to girls, with a boy-girl ratio of 1.6:1. However, this ratio is smaller compared to other research findings. The literature also indicates that boys experience more problems compared to girls, with a boy-girl ratio of 2:1 (Wright & Sugden, 1996). Wessels *et al.* (2008) found the ratio to be 2-3:1. Furthermore, Rivard *et al.* (2007) estimated that the gender difference could even be as high as 3-4:1. Hoare and Larkin (1991) also found that more boys than girls are attending remedial programmes for DCD (9:1), supporting the belief that boys experience more problems as found in the current study.

Although gender differences do occur, researchers need to take into consideration that gender differences are a normal phenomenon in the attainment of motor skills among children. Literature indicates that girls perform better in fine motor skills, whilst boys are better at gross motor skills (Gallahue & Ozmun, 2006). Junaid and Fellowes (2006) reported that, when using the MABC, girls outperformed the boys with regard to manual dexterity items and the boys were superior on the ball skills items. No differences were established between the balancing skills of boys and girls. Junaid and Fellowes (2006) also argue that these differences are due to the disparity between the acquisition of motor skills between boys and girls.

Limited research is reported on the difference between various ethnic groups. The current study indicates that Caucasian children experienced less moderate- and severe motor difficulties (5.3%). Similar findings were reported by Wessels *et al.*, (2008) on a smaller population sample of 99 children in Potchefstroom, North West Province. The Caucasian learners had a 9% prevalence of moderate motor difficulties and 5% severe motor difficulties. The Black learners of the current study demonstrate a 10.6% moderate motor difficulties and 9.7% severe motor difficulties. This higher prevalence amongst Black learners is supported by Wessels *et al.* (2008) who reported an even higher prevalence of moderate motor difficulties (15%) and severe motor difficulties (17%). With reference to the Mixed-race a higher prevalence were established in the current study, moderate motor difficulties (14.2%) and severe motor difficulties (21.4%). Contrary Wessels *et al.*, (2008) found that the Mixed-race had the lowest prevalence of moderate motor difficulties (5%) and severe motor difficulties (1%) respectively. The current research indicates a trend towards a higher

prevalence in Black learners with a suggestion of even a higher prevalence in learners of Mixed-race. Wessels *et al.*, (2008) stated that socio economic status may be a reason for differences between ethnic groups and the prevalence of DCD. A limitation in the current study was the unequal distribution between the various ethnic groups, which could have influenced the prevalence of DCD and should be therefore taken into consideration in future research.

Conclusion

The prevalence of DCD (15%) of school age children in the current study was higher compared to the findings reported in the literature (5-6%). It is also clear that although minor differences do exist in relation to gender, boys still have a significant higher incidence of DCD. Finally, it can be concluded that the research identified a trend towards a higher prevalence of DCD in Black- and Mixed-race learners.

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